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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/608,152

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Hakansson Bo

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04/30/2009

AKZO NOBEL INC.

LEGAL & IP

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TARRYTOWN, NY 10591

EXAMINER

WILKINS III, HARRY D

ART UNIT

PAPER NUMBER

1795

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PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/608,152	<b>Applicant(s)</b> BO ET AL.	
	<b>Examiner</b> Harry D. Wilkins, III	<b>Art Unit</b> 1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 26 February 2009.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-12 and 23-25 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-12 and 23-25 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 21 November 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)            | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | Paper No(s)/Mail Date. _____                                      |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>4/2/09</u> .  | 6) <input type="checkbox"/> Other: _____                          |

## **DETAILED ACTION**

### ***Information Disclosure Statement***

1. The information disclosure statement (IDS) submitted on 2 April 2009 is in compliance with the provisions of 37 CFR 1.97. Accordingly, the information disclosure statement is being considered by the examiner.
2. Per a discussion between the examiner and Applicant's representative, it is noted that the cover sheet attached to the IDS contained the wrong bibliographic information regarding the identity of the application. During the discussion it was determined that the IDS is proper for this application and it is being entered into the record of this application.

### ***Claim Rejections - 35 USC § 103***

3. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.
4. Claims 1-6, 9-11, 23 and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Millet (US 5,104,499) in view of Oda et al (US 4,299,682).

Millet teaches (see abstract and col. 2, lines 28-45) a process for electrolytic production of alkali metal chlorate in an electrolytic cell divided by a cation selective separator into an anode compartment in which an anode is arranged and a cathode compartment. The process included the steps of introducing an anolyte solution containing alkali metal chloride into the anode compartment, electrolyzing the solution to produce alkali metal chlorate and producing alkali metal hydroxide in the cathode compartment. After being electrolyzed the solution was transferred to a reactor to

produce a concentrated alkali metal chlorate electrolyte prior to ultimate crystallization of the alkali metal chlorate in the reactor.

Thus, Millet fails to teach using a gas diffusion cathode in the cathode compartment and the step of feeding oxygen-containing gas into the cathode compartment.

Of importance is that the reaction at the cathode of Millet produces hydrogen gas and hydroxide ions from the water.

Oda et al teach (see abstract, figure 2, col. 1 and col. 4, line 30-col. 6, line 5) that in divided electrolytic cells for the electrolytic production of  $\text{Cl}_2$  and  $\text{NaOH}$ , the operating voltage of the cell can be reduced by using a gas diffusion cathode, and feeding oxygen to the cathode through a gas chamber (9). The reaction at the cathode involves reaction of the oxygen gas with the water to form hydroxide ions without producing hydrogen gas.

Therefore, it would have been obvious to one of ordinary skill in the art to have used the gas diffusion cathode as taught by Oda et al in the divided electrolysis cell taught by Millet because of the decreased operating voltage which leads to an increased current efficiency.

It is noted that the cathode reaction provided by the process cell of Oda et al is identical to the cathode reaction provided by the process of Millet. Both cathodes react an incoming  $\text{NaOH}$  catholyte to produce additional  $\text{NaOH}$  at the cathode. Therefore, one of ordinary skill in the art would have had a reasonable expectation of successfully substituting the gas diffusion electrode of Oda et al into the cell of Millet.

Regarding claim 2, Oda et al teach (as above, figure 2) that the gas diffusion electrode divided the cathode compartment into a gas chamber (9) on one side of the gas diffusion electrode and an alkali metal hydroxide chamber (7) on the other side thereof. An alkali metal solution was introduced to the alkali metal hydroxide chamber at 12 and an oxygen containing gas was introduced to the gas chamber at 14.

Regarding claim 3, Oda et al teach (as above) using a cation selective membrane.

Regarding claim 4, the anolyte of Millet had a pH of 6.2 to 6.6.

Regarding claim 5, the anolyte of Millet contained about 100-200 g/L of chloride.

Regarding claim 6, the anolyte of Millet contained about 400-600 g/L of an alkali metal chlorate.

Regarding claim 9, Millet teaches the desire to perform the electrolysis without any chromates present.

Regarding claims 10 and 24, Millet teaches (see example 1) using a catholyte of 20 wt% NaOH (~250 g/L). It would have been obvious to one of ordinary skill in the art to have optimized the amount of NaOH fed to the cathode compartment in order to balance the necessary cost of the NaOH against any increases in productivity produced by adding more NaOH.

Regarding claim 11, Millet teaches (see example 1) operation of the cell at 63°C.

Regarding claim 23, the cell of Oda et al included (see figure 2) a gas diffusion electrode (8) which divided the cathode compartment into a gas chamber (9) on one side of the gas diffusion electrode and an alkali metal hydroxide chamber (7) on the

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other side between the gas diffusion electrode and the cation selective separator. The process of Oda et al included (see Example 1) introducing a weak alkali metal hydroxide solution into the alkali metal hydroxide chamber and oxygen containing gas into the gas chamber. The cation selective separator was a membrane. Millet teaches (see abstract and col. 2) using a pH of the solution of 6.2-6.6.

5. Claims 1, 3-6, 9-11, 24 and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Millet (US 5104,499) in view of Shimamune et al (US 6,117,286).

Millet teaches (see abstract and col. 2, lines 28-45) a process for electrolytic production of alkali metal chlorate in an electrolytic cell divided by a cation selective separator into an anode compartment in which an anode is arranged and a cathode compartment. The process included the steps of introducing an anolyte solution containing alkali metal chloride into the anode compartment, electrolyzing the solution to produce alkali metal chlorate and producing alkali metal hydroxide in the cathode compartment. After being electrolyzed the solution was transferred to a reactor to produce a concentrated alkali metal chlorate electrolyte prior to ultimate crystallization of the alkali metal chlorate in the reactor.

Thus, Millet fails to teach using a gas diffusion cathode in the cathode compartment and the step of feeding oxygen-containing gas into the cathode compartment.

Of importance is that the reaction at the cathode of Millet produces hydrogen gas and hydroxide ions from the water.

Shimamune et al teach (see abstract and cols. 1-3) that great savings in electricity can be realized by substituting a gas diffusion cathode for a regular hydrogen evolving cathode in a membrane electrolytic cell. Further, the cell in which the gas diffusion cathode is placed adjacent to the separator/membrane, i.e.-zero-gap, solves many problems associated with either the hydrogen evolving cathode or the three-chamber gas diffusion electrode cells.

Therefore, it would have been obvious to one of ordinary skill in the art to have substituted the gas diffusion cathode of Shimamune et al for the hydrogen evolving cathode of Millet because Shimamune et al teach that doing so can provide significant cost savings in terms of electricity consumed.

Regarding claim 3, both Millet and Shimamune et al teach using a cation selective membrane.

Regarding claim 4, the anolyte of Millet had a pH of 6.2 to 6.6.

Regarding claim 5, the anolyte of Millet contained about 100-200 g/L of chloride.

Regarding claim 6, the anolyte of Millet contained about 400-600 g/L of an alkali metal chlorate.

Regarding claim 9, Millet teaches the desire to perform the electrolysis without any chromates present.

Regarding claims 10 and 24, Millet teaches (see example 1) using a catholyte of 20 wt% NaOH (~250 g/L). It would have been obvious to one of ordinary skill in the art to have optimized the amount of NaOH fed to the cathode compartment in order to

balance the necessary cost of the NaOH against any increases in productivity produced by adding more NaOH.

Regarding claim 11, Millet teaches (see example 1) operation of the cell at 63°C.

Regarding claim 25, Shimamune et al teach (see cols. 2-3) that arranging the gas diffusion cathode adjacent to the membrane permitted several problems with three-chamber gas diffusion electrode cells to be overcome.

6. Claims 1-5, 7, 9-11 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cook, Jr. (US 3,897,320) in view of Oda et al (US 4,299,682).

Cook, Jr. teaches (see abstract, figure and col. 1, line 52 to col. 2, line 39) a process of making alkali metal chlorate including the steps of introducing an electrolyte solution containing alkali metal chloride into the anode compartment (27) of a divided electrolytic cell (11), electrolyzing the electrolyte solution to produce alkali metal chlorate in an electrolyzed solution in the anode compartment, forming alkali metal hydroxide in the cathode compartment (29), and transferring the electrolyzed solution from the anode compartment to a chlorate reactor (35) to react the electrolyzed solution further to produce a concentrated alkali metal chlorate electrolyte.

Thus, Cook, Jr. do not teach using a gas diffusion cathode in the divided electrolytic cell and feeding oxygen gas to the gas diffusion cathode.

Oda et al teach (see abstract, figure 2, col. 1 and col. 4, line 30-col. 6, line 5) that in divided electrolytic cells for the electrolytic production of  $\text{Cl}_2$  and NaOH, the operating voltage of the cell can be reduced by using a gas diffusion cathode, and feeding oxygen to the cathode through a gas chamber (9).



Therefore, it would have been obvious to one of ordinary skill in the art to have used the gas diffusion cathode as taught by Oda et al in the divided electrolysis cell taught by Cook, Jr. because of decreased operating voltage which leads to an increased current efficiency.

It is noted that the overall reaction provided by the process cell of Oda et al is identical to the reaction provided by the process of Cook, Jr. Both cells react an incoming NaCl anolyte and NaOH catholyte to produce  $\text{Cl}_2$  gas at the anode and additional NaOH at the cathode. The  $\text{Cl}_2$  of Cook, Jr. immediately dissolves into the solvent (water) to form HClO and HCl. Additionally, the membrane of Oda et al would have permitted a small amount of the hydroxide ions to cross, similarly to Cook, Jr, resulting in the formation of at least some chlorate ions in the anode chamber. Therefore, one of ordinary skill in the art would have had a reasonable expectation of successfully substituting the gas diffusion electrode of Oda et al into the cell of Cook, Jr.

Regarding claim 2, Oda et al teach (as above, figure 2) that the gas diffusion electrode divided the cathode compartment into a gas chamber (9) on one side of the gas diffusion electrode and an alkali metal hydroxide chamber (7) on the other side thereof. An alkali metal solution was introduced to the alkali metal hydroxide chamber at 12 and an oxygen containing gas was introduced to the gas chamber at 14.

Regarding claim 3, Oda et al teach (as above) using a cation selective membrane.

Regarding claim 4, Cook, Jr. teaches (see abstract and col. 3) using a pH of the solution of 2-6.

Regarding claim 5, Cook, Jr. teaches (see col. 3) a chloride concentration of 200-320 g/l.

Regarding claim 7, Cook, Jr. teaches (see col. 3) that the recycled electrolyte from the crystallizer (61) is not free of chlorate ions and that the chlorate was present at an amount smaller than the chloride in the recycled electrolyte which was 50-100 g/L. Thus, the recycled electrolyte, ultimately fed into the divided electrolytic cell after saturation with sodium chloride would have contained the claimed amount of chlorate ions.

Regarding claim 9, Cook, Jr. does not teach adding any chromate to the electrolyte.

Regarding claim 10, Cook, Jr teaches (see col. 7, lines 45-48) producing a sodium hydroxide concentration of 250-450 g/L.

Regarding claim 11, Cook, Jr. teaches (see col. 7, lines 17-28) controlling the temperature of the electrolyte to be less than 105°C, most preferably in the range of 65 to 85°C.

Regarding claim 23, the cell of Oda et al included (see figure 2) a gas diffusion electrode (8) which divided the cathode compartment into a gas chamber (9) on one side of the gas diffusion electrode and an alkali metal hydroxide chamber (7) on the other side between the gas diffusion electrode and the cation selective separator. The process of Oda et al included (see Example 1) introducing a weak alkali metal hydroxide solution into the alkali metal hydroxide chamber and oxygen containing gas

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into the gas chamber. The cation selective separator was a membrane. Cook, Jr teaches (see abstract and col. 3) using a pH of the solution of 2-6.

7. Claims 1-6, 8, 10-12 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wanngard (US 5,419,818) with evidence from Cook, Jr. (US 3,897,320) in view of Oda et al (US 4,299,682).

Wanngard teaches (see col. 1, lines 18-37, cols. 3-6) a process for producing alkali metal chlorate in a divided electrolytic cell (12) including electrolyzing the anolyte electrolyte solution and transferring the electrolyzed solution to a chlorate reactor (4 or 5). The cell (12) of Wanngard was preferably divided by a cationic selective membrane.

Wanngard teach that the electrolytic cell (12) is a divided electrolytic cell. In this process, the anolyte fed to the cell included NaCl and the catholyte included NaOH. The anolyte was electrolyzed to generate  $\text{Cl}_2$  gas at the anode and the catholyte was electrolyzed to generate NaOH at the cathode. The  $\text{Cl}_2$  was immediately hydrolyzed into HClO and HCl (Wanngard at col. 3, lines 59-68). The HClO is then reacted in the chlorate reactor to form sodium chlorate ( $\text{NaClO}_3$ ).

Wanngard fails to teach the production of any chlorate within the divided electrolytic cell. However, it was known to one of ordinary skill in the art that any hydroxide ions crossing the membrane in a divided electrolytic cell would react with the hypochlorite ions ( $\text{ClO}^-$ ) to cause formation of chlorate ions ( $\text{ClO}^{-3}$ ). Evidence of this knowledge can be seen in Cook, Jr. at col. 2, lines 5-26, which states that cation-active permselective membranes allow some hydroxyl ions to migrate through from catholyte to anolyte. The hydroxyl ions then react in the anolyte to produce chlorate. Thus, in the

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process of Wanngard, at least some chlorate ions were produced in the anode compartment of the divided electrolytic cell.

Thus, Wanngard fails to teach the claimed cell which had a gas diffusion cathode and feeding oxygen to the gas diffusion cathode.

Oda et al teach (see abstract, figure 2, col. 1 and col. 4, line 30-col. 6, line 5) that in divided electrolytic cells for the electrolytic production of  $\text{Cl}_2$  and  $\text{NaOH}$ , the operating voltage of the cell can be reduced by using a gas diffusion cathode, and feeding oxygen to the cathode through a gas chamber 9.

Therefore, it would have been obvious to one of ordinary skill in the art to have used the gas diffusion cathode as taught by Oda et al in the divided electrolysis cell taught by Wanngard because of decreased operating voltage which lead to an increased current efficiency.

It is noted that the overall reaction provided by the process cell of Oda et al is identical to the reaction provided by the process of Wanngard. Both cells react an incoming  $\text{NaCl}$  anolyte and  $\text{NaOH}$  catholyte to produce  $\text{Cl}_2$  gas at the anode and additional  $\text{NaOH}$  at the cathode. The  $\text{Cl}_2$  of Wanngard immediately dissolves into the solvent (water) to form  $\text{HClO}$  and  $\text{HCl}$ . Additionally, the membranes of Wanngard and Oda et al would have permitted a small amount of the hydroxide ions to cross, similarly to Cook, Jr, resulting in the formation of at least some chlorate ions in the anode chamber. Therefore, one of ordinary skill in the art would have had a reasonable expectation of successfully substituting the gas diffusion electrode of Oda et al into the cell of Wanngard.

Regarding claim 2, Oda et al teach (as above, figure 2) that the gas diffusion electrode divided the cathode compartment into a gas chamber (9) on one side of the gas diffusion electrode and an alkali metal hydroxide chamber (7) on the other side thereof. An alkali metal solution was introduced to the alkali metal hydroxide chamber at 12 and an oxygen containing gas was introduced to the gas chamber at 14.

Regarding claim 3, Oda et al teach (as above) using a cation selective membrane.

Regarding claims 4-6 and 11, Wanngard teaches (see col. 6) using a pH of the solution of 5.5-6.5, a chloride concentration of 100-140 g/l, a chlorate concentration of 500-650 g/l and a temperature of 50-100°C.

Regarding claim 8, Wanngard teaches (see col. 7, lines 5-8) using a minor addition of sodium chromate. It would have been obvious to one of ordinary skill in the art to have optimized the amount of chromate used.

Regarding claim 10, Wanngard does not disclose a concentration of sodium hydroxide in the catholyte. However, it would have been obvious to one of ordinary skill in the art to have optimized the concentration of the hydroxide being produced in the electrolyzer in order to achieve proper reaction rate.

Regarding claim 12, Wanngard teaches feeding both the electrolyzed anolyte and the electrolyzed catholyte to the chlorate reactor (4).

Regarding claim 23, the cell of Oda et al included (see figure 2) a gas diffusion electrode (8) which divided the cathode compartment into a gas chamber (9) on one side of the gas diffusion electrode and an alkali metal hydroxide chamber (7) on the

other side between the gas diffusion electrode and the cation selective separator. The process of Oda et al included (see Example 1) introducing a weak alkali metal hydroxide solution into the alkali metal hydroxide chamber and oxygen containing gas into the gas chamber. The cation selective separator was a membrane. Wanngard teaches (see cols. 3-4) using a pH of the solution of 5.0-7.5.

### ***Response to Arguments***

8. Applicant's arguments filed 26 February 2009 have been fully considered but they are not persuasive. Applicant has argued that:

- a. The cation-active permselective membrane disclosed by Cook, Jr. is significantly different from the claimed cation selective separator.

In response, see page 3, lines 9-19 of the present specification for the definition of the claimed cation selective separator. This indicates that it is conventionally available as various types of Nafion™ membranes sold by DuPont. Cook, Jr. describes (see paragraph spanning cols. 3 and 4) the suitable membranes were copolymers of tetrafluoroethylene and PSEPVE. Dankese teaches (see col. 1, lines 27-37) that the Nafion™ membranes were known to be copolymers of tetrafluoroethylene and PSEPVE. Thus, the membrane disclosed by Cook, Jr. is considered to be essentially identical to the claimed cation selective separator.

- b. There is no electrolytic cell in Wanngard that produces chlorate ions.

In response, as previously set forth by the examiner, and reiterated above, Wanngard, with evidence from Cook, Jr produces at least some chlorate ions in the divided electrolytic cell (12).

- c. The combination of Wanngard, which feeds a chlorate electrolyte to both anode and cathode compartments, with Oda et al would result in poisoning of the gas diffusion cathode due to the presence of chlorate in the catholyte.

In response, Applicant's remark is unsupported by any evidence showing this to be true. Conclusory statements are not probative unless supported by facts. See *Ex parte Gray* 10 USPQ 2d 1922 (BPAI 1989); *In re deBlauwe* 222 USPQ 191, 196 (Fed. Cir. 1984); *In re D'Ancicco* 172 USPQ 241 (CCPA 1972); *In re Grunwell* 203 USPQ 1055 (CCPA 1979); *Meitzner v. Mindick* 193 USPQ 17; *In re Brandstandter* 179 USPQ 286, 294 (CCPA 1973); *In re Lindner* 173 USPQ 356; and, *In re Smith* 74 USPQ 207.

### **Conclusion**

Applicant's submission of an information disclosure statement under 37 CFR 1.97(c) with the fee set forth in 37 CFR 1.17(p) on 2 April 2009 prompted the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 609.04(b). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

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the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Harry D. Wilkins, III whose telephone number is 571-272-1251. The examiner can normally be reached on M-F 8:30am-5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick Ryan can be reached on 571-272-1292. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/Harry D Wilkins, III/  
Primary Examiner, Art Unit 1795

hdw